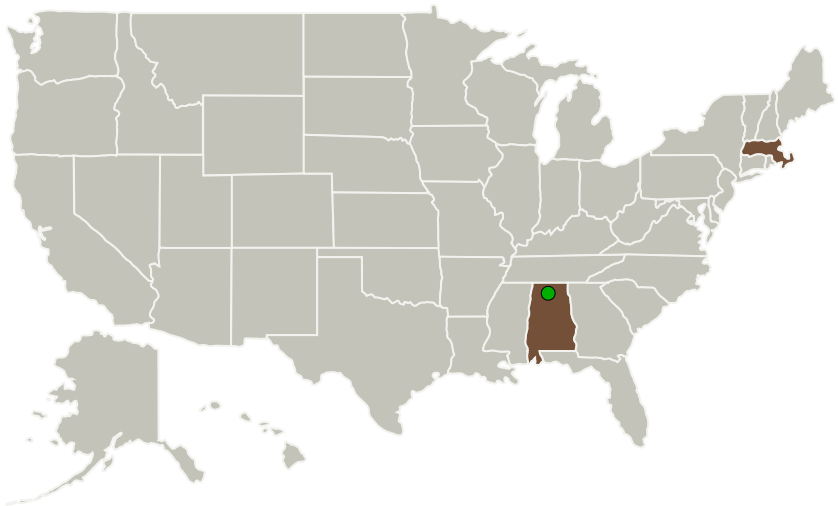
BeatMark Software to Reduce the Cost of X-Ray Mirror Fabrication by Optimization of Polishing and Metrology Cycle, Phase II

Completed Technology Project (2016 - 2019)

Project Introduction

For X-Ray optics, polishing the mirrors is one of the most costly steps in the fabrication of the system. BeatMark software will significantly decrease the cost of X-Ray mirror production. BeatMark will allow for parametrization of surface metrology data, which will be used as feedback for polishing parameter optimization and metrology experiment planning. By providing the parametrized optical surface description, BeatMark will optimize the costly polishing-and metrology cycle and enable numerical simulation of the performance of new X-Ray mirrors performed by NASA. BeatMark will help fulfill the requirements for sophisticated and reliable information about the expected surface slope and height distributions of prospective X-Ray optics before the optics are fabricated. As we demonstrated in Phase I, an optical surface can be thought of as a stationary uniform stochastic process and modeled with optimal Invertible Time Invariant Filters (InTILF). It was further shown that the modeling of one-dimensional (1D) slope measurements allows highly confident fitting of the X-Ray mirror metrology data with a limited number of parameters and a 10-15% reduction of required length of metrology profiles. Theoretically, a reduction of 50% is possible. In Phase II, we will conduct field tests to assess what reduction in metrology is practical and implementable. With the parameters of the InTILF model developed in Phase I, the surface slope profile of optics with a new specification can be forecast reliably. BeatMark will also process 2-D metrology data and provide a polishing optimization method, based on analysis of the mirror quality response to the polishing parameters. Our Phase I studies indicated that the optimal InTILF modeling describes the mirror surfaces with very few filter parameters and high spectral accuracy.

Primary U.S. Work Locations and Key Partners



BeatMark Software to Reduce the Cost of X-Ray Mirror Fabrication by Optimization of Polishing and Metrology Cycle, Phase II

Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

BeatMark Software to Reduce the Cost of X-Ray Mirror Fabrication by Optimization of Polishing and Metrology Cycle, Phase II

Completed Technology Project (2016 - 2019)

Organizations Performing Work	Role	Type	Location
Second Star Algonumerix	Lead Organization	Industry	Needham, Massachusetts
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Massachusetts

Project Transitions

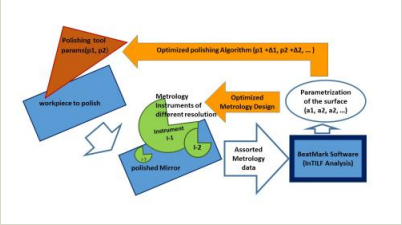
May 2016: Project Start

May 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139829)*

Images



Briefing Chart Image
BeatMark Software to Reduce the Cost of X-Ray Mirror Fabrication by Optimization of Polishing and Metrology cycle, Phase II *(https://techport.nasa.gov/image/131221)*

Final Summary Chart Image
BeatMark Software to Reduce the Cost of X-Ray Mirror Fabrication by Optimization of Polishing and Metrology Cycle, Phase II *(https://techport.nasa.gov/image/132417)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Second Star Algonumerix

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

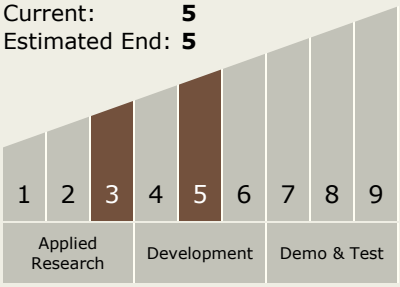
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Anastasia Tyurina

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



BeatMark Software to Reduce the Cost of X-Ray Mirror Fabrication by Optimization of Polishing and Metrology Cycle, Phase II

Completed Technology Project (2016 - 2019)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System